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AMERICAN JOURNAL OF OPTOMETRY

VOL. 7 NO. 1

ZONES OF OCULAR COMFORT*

Charles Sheard, Ph. D.

Division on Physics and Biophysical Research, The Mayo Foundation, Rochester, Minnesota, and Professor of Biophysics and Physiological Optics The Graduate School of Medicine, University of Minnesota.

Asthenopia, the symptoms of which are not relieved by the correction of errors of refraction alone, is encountered frequently enough to warrant a thorough discussion of ways and means of obtaining ocular data which may be of value as diagnostic aids and as suggestions regarding possible subsequent treatment. There are persons, commonly said to be of the neurotic type, who experience ocular discomfort and who, even after numerous examinations covering a period of years, fail to receive relief. Small and apparently trifling changes have been made in the dioptric strengths of the glasses prescribed; the axes of the cylinders have been shifted slightly; possibly some one may have been bold enough to add small amounts of prisms with directions of their bases as may have suited his fancy. But in spite of it all, the symptoms of which the patients complain continue and, as Percival[6] stated: "Finally, in despair, they abandon the spectacles which they cannot wear with comfort and seek relief in the last new drug advertised to cure headaches."

Asthenopia.

Is the asthenopia due to constitutional defects, to excessive efforts of the ciliary muscle to maintain accommodation, to the endeavors of the extra-ocular muscles in maintaining binocular single vision or to a combination of accommodative demands, fusional demands and low functional reserves? Either constitutional or local ocular conditions, or both, may be factors. It must be admitted that errors of refraction or muscular imbalances which would be insufficient to produce discomfort, when both bodily and ocular functions

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are strong, are capable of producing disproportionate discomfort and other symptoms when bodily weakness exists. It seems to me that those who practice in any wise on the human body frequently fail to appreciate the fact that symptoms of discomfort, as well as untoward effects produced by causes, such as focal infections, are somewhat in proportion to the absence of a state of well-being. These symptoms and untoward effects depend on the character of occupation, the mental outlook and habits, and the weakness or strength in the functions of the part of the body to which the discomfort is attributed. In brief, when functions are in strength and possess ample reserves, they are capable of meeting demands or of offsetting deficits in a degree which would be impossible, at least without inefficiency and discomfort, when these functions are in weakness.

Relationships Between Accommodation and Convergence.

In conditions of ocular discomfort which are not relieved by spherical or cylindrical lenses or combinations of them, attention should be directed to the relationships between convergence and accommodation. Many years ago Donders[1], in his classic treatise, first drew attention to these relationships. In the last three-quarters of a century many contributions have been made regarding the dependence and independence of resources of accommodation and convergence.[2 3 4 5 8 12] Charts showing the relative ranges of positive and of negative accommodation for any given degrees of convergence, and the relative divergences and convergences with various amounts of accommodative action, indicate that there is considerable independence of these functions. In most cases, then, the relation between convergence and accommodation can be altered considerably to meet the different requirements which the individual may have from the standpoints of distinct and of single vision. However, conditions do arise in which the relative ranges of convergence and of accommodation indicate clearly that distinct and single vision cannot be maintained with comfort. Discomfort, to be sure, is noted frequently when glasses first are worn; doubtless this is due to the new co-ordination or readjustments of convergence and accommodation, for the discomfort shortly disappears. It is not such temporary discomfort which I am discussing, but rather the persistent type which is not readily alleviated and in which some difficulty prevents the proper adaptation and correlation of convergence and accommodation.

Any amount of accommodation can be elicited or suppressed by the use of convex or spherical lenses; any number of degrees of convergence or divergence can be induced through the use of prisms, placed with bases in and out respectively. These data, when plotted,

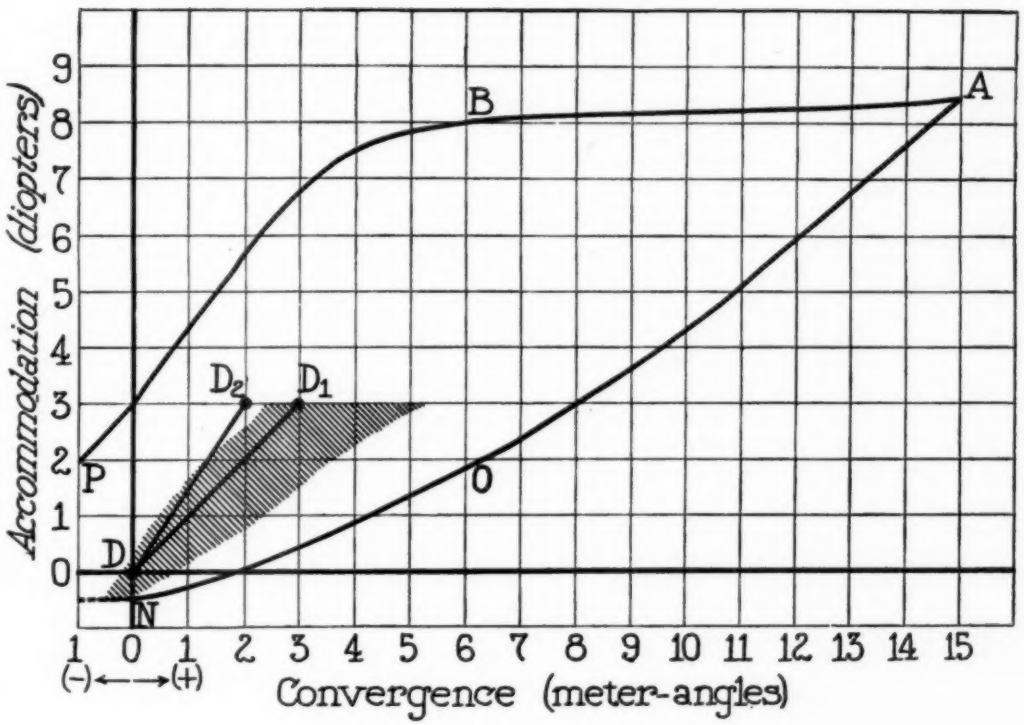

FIG. 1

Fig. 1. Curves showing the relations between accommodation and convergence in a person with normal (standard) vision and no ocular discomfort. The line PBA shows the relative positive amplitudes of accommodation and the line NOA gives the relative negative amplitudes of accommodation for various meter-angles of convergence. The shaded area is the zone of comfort (after Percival).

give curves of the type shown in Figure 1 which I have selected from those presented by Percival[7] for reasons which will be evident shortly. The curve PBA shows the positive relative accommodation obtained through the use of concave lenses for various meter-angles of convergence and the curve NOA represents the negative relative amplitudes of accommodation obtained through the use of convex lenses for like conditions of convergence. A glance at the curves shows that the person under test exhibited a maximum of convergence of 15 meter-angles and a maximum of accommodation of 8.5 diopters which, when added to the 0.5 diopter of hyperopia, as indicated at the point N, represents 9 diopters of accommodation. The horizontal line gives the relative convergence for each diopter of accommodation (indicated on the vertical line) exerted or suppressed. Thus, at the point marked 4 (actually indicating 4.5 diopters

of accommodation) the range of convergence was from 0.75 to 9.5 meter-angles; at 7.5 diopters the range of convergence was from 4 meter-angles to 13.5 meter-angles. In a similar manner the range of accommodation under a specified amount of convergence is indicated by the vertical lines. Thus, when exerting 5 meter-angles of convergence, the range of accommodation is denoted by the line from 8.5 diopters (8 diopters plus 0.5 diopter of hyperopia) to 1.5 diopters. It is obvious, therefore, that the amount of convergence that can be exercised is dependent on the amount of accommodation that is exerted at the same time. Also it is apparent that these relationships of accommodation and convergence will vary greatly with refractive errors and with the resources of accommodation and convergence of the person under test.

Curves such as those shown in Figure 1 contain a complete survey of the dependence and independence of the functions of accommodation and convergence. Data regarding the positive and negative relative accommodations and the positive and negative relative convergences are readily obtained from the plotted data. I[9 10] have contended for a number of years that the data regarding the absolute ranges of accommodation and of convergence are of little value as compared to information regarding the *relative* ranges of convergence, and that limitations in relative accommodation, relative convergence, or both, are the prime factors in ocular discomfort. As shown in Figure 1, the person under test, with 3 meter-angles of convergence demanded and delivered (hence fixing a point 33.3 cm. from the eyes) has a positive relative accommodation of 4 diopters and a negative relative accommodation of 2.5 diopters; a positive relative convergence, or positive fusion reserve, of 5 meter-angles and a negative relative convergence of 3 meter-angles. These data show that distinct binocular single vision can be obtained and maintained with considerable variation in the functioning of the extra-ocular muscles, as evidenced by prisms with bases in or out, and of the ciliary muscle, as evidenced by plus and minus lenses.

The line DD_1 (fig. 1) is the locus of points in which the accommodation in diopters, and the convergence, in meter-angles, have the same value. With no accommodation there is no convergence: with 3 diopters of accommodation there are 3 meter-angles of convergence. If, under dissociation tests, such conditions should be found to exist the conclusion would be warranted that all of the convergence necessary for binocular single vision at any point was in accompaniment with the act of accommodation. Whether or not such a condition exists is determined by dissociation tests (as with 6 prism diopters, base up or down before one eye), the person under test reading or endeavoring to read at the distance of test. I believe it has been demonstrated that, at the usual reading distance of about 33 cm., there is normally an exophoria of 4 to 6 prism diopters.[11 18]

As a result, therefore, in the normal physiologic relationships between accommodation and convergence at the ordinary reading distance, about two-thirds of the necessary convergence comes in association with the act of accommodation and the remaining third through fusional sources. Hence, in Figure 1 the line DD_1 would start at the zero point, but instead of running at an angle of 45° it would occupy an angular position of practically 35° with reference to the *Y* axis (accommodation) as shown at DD_2. This point should be noted and borne in mind since conclusions as to the necessity for prisms will depend, in part at least, on which position of the line (DD_1 or DD_2) is taken as a standard.

Absolute Versus Relative Convergence

Many authorities have taken the absolute range of convergence as a basis on which to form a judgment regarding the probable role which weakness of extra-ocular innervation plays in discomfort and the necessity for the use of prismatic relief. Landolt* made the suggestion that not more than a third of the absolute range of convergence can be exercised continuously without fatigue. It appears much more logical in theory, and is apparently substantiated in practice, to state that the basis of relief for extra-ocular imbalances should be founded on the relative range rather than on the absolute range of convergence; for that part of the absolute range which is beyond the

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*The original article entitled "L'Amplitude de Convergence," appeared in Archives d'Ophthalmologie, 1885, v. 108.

In the volume "The Refraction and Accommodation of the Eyes and Their Anomalies," by Dr. Landolt, there are several pages (340-347) devoted to a discussion of the necessity for ample reserves, both of accommodation of convergence. Because of the inaccessibility of Landolt's writings I am quoting two paragraphs (p. 342) concerning convergence reserve:

"The experiments which I have made with a view to furnishing the answer to this question [the quota of convergence that it is necessary to hold in reserve] are of recent date and not yet as numerous as I could wish. They tend to show that the quota of convergence, which can be utilized for continuous work, ought not to amount to more than one-third or even one-fourth of the positive convergence power; hence that two-thirds to three-fourths of the latter should be kept in reserve. Whence it results that a person with a **p** [absolute punctum proximum] of 9 meter-angles has just the absolutely necessary amount of convergent power for work at the ordinary distance of one-third of a meter, but no more. For one-quarter of a meter (25 cm.) the strength of his adductors would no longer suffice. They would soon become fatigued. In fact, continued binocular vision at this point requires at least 12 meter-angles of positive convergence (p), 4 meter-angles of immediate use and twice as many (8) to make up for the force expended.

"This large amount of the reserve quota might at first sight seem astonishing, but only so to ophthalmologists, who involuntarily compare the quota of convergence with the corresponding quota of accommodation. It naturally occurs to us that the relation of the two parts to each other, in the two cases, is just reversed. One may employ two-thirds of one's accommodation in working and need hold back but one-third; on the contrary, two-thirds of the convergence must be held in reserve in order that one may work with the remaining third."

relative portion, for any given amount of accommodation, cannot possibly be brought into action and must be excluded therefore. Some years ago I[9 10] proposed that, as a general rule, not more than a half to a third of the relative positive or negative convergence, depending on whether the muscular imbalance was a condition of exophoria or esophoria, could be used continuously without producing fatigue and other untoward symptoms generally classed under the term discomfort. I believed that it was possible to draw conclusions regarding the possibility of binocular single vision and whether or not binocular single vision could be obtained with comfort. But first the extra-ocular imbalance at the point of fixation, and hence the *amount of the demand* on the functions of convergence to maintain binocular single vision, must be found. Furthermore, it would be necessary to know the values of the relative convergence, adduction and abduction or positive reserve and negative reserve convergences, thereby obtaining information regarding the *total powers of innervation* of the recti muscles and the *fusional reserve.* As a routine procedure, therefore, data must be obtained both with and without lenses correcting the refractive errors. These data must bear on the following: (1) the demands on the ciliary and extra-ocular muscles and (2) the accommodative and fusional reserves at the two points of fixation, namely, at 6 meters and at the usual reading distance of approximately 33 cm. Percival,[6 7] in writing on the relation of convergence to accommodation and its practical bearing, states that for various reasons he omits all tests with Maddox rod, Maddox double prism, or similar dissociating devices for finding the amount of imbalance exhibited by the extra-ocular muscles. He lays particular emphasis, however, on the relationship between the position of the diagonal line of equal accommodation-convergence and the limits of the positive and negative relative convergences, with fixation at 6 meters and at the normal reading distance. In the matter of the value of the tests of tonicity at distant and near points I believe that the weight of evidence as well as of actual practice is against the view of Percival.

In obtaining the breadth of fusion either at 6 meters or at 33 cm., the patient should fix his attention on the smallest letter that he can see at a distance of 6 meters or on the ruled line or vertical row of small letters at the reading distance. Then, as prisms are placed before the eye, he should report as soon as the letters or the lines begin to be blurred or indistinct. By this procedure constancy of the amount of accommodation involved for the given distance of fixation is assured. If the patient is allowed to exercise his accommodation, a much greater amount of convergence is possible. In all tests the patient is to wear the lenses which correct refractive errors and, at the reading distance, such lenses as compensate for the presbyopic condition if this is present.

Area of Comfort.

In so far as I know, Percival[6] was the originator of the expression "area of comfort." In his paper of 1892 he wrote: "I think we may assume tentatively as a working hypothesis that the *area of comfort* occupies about the middle third of the relative range of convergence between the limits corresponding to an exertion of zero diopter and 3 diopters of accommodation. I have defined the limits in this way from a careful examination of my notes and charts, assuming that when a prism gives relief it brings the diagonal [DD_1 of figure 1] within the area of comfort."

Weymouth, Brust and Gobar, in their paper on "Ocular Muscle Balance at the Reading Distance and Other Related Factors," commented: "Percival's (1892) conception of an 'area of comfort' occupying the middle third of the zone of relative accommodation and convergence is, we consider, a very valuable one, and our figures are in accord with the main features of this."

Illustrative Cases.

As illustrating the conceptions of Percival and their application in routine refraction I am including data and the accompanying Figure 2 regarding a "Mrs. F., a neurotic emmetrope, age 25, who suffered from asthenopia that was found to be due to an abnormal

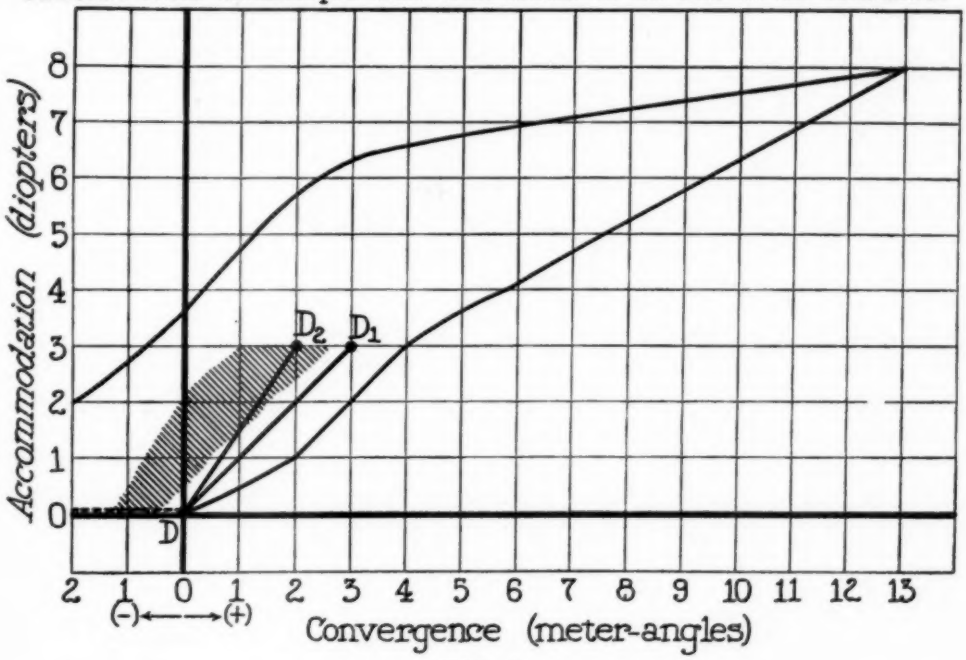

FIG. 2

Fig. 2. Curves of relative accommodation and convergence in the case of a person having excessive divergence (exophoria) and insufficient relative convergence. The shaded area represents the zone of comfort. The line of equal accommodation and convergence lies to the right of the area of comfort.

relative range of convergence. Her chart [Fig. 2] shows that, with her accommodation relaxed, she could diverge two meter-angles and could also just maintain parallelism. When 3 diopters of accommodation was exerted her range of convergence was from — 0.5 meter-angles to + 4.0 meter-angles. The diagonal was about 0.5 meter-angles on the positive side of her area of comfort. She had been given + 1 diopter glasses for reading, which only aggravated her difficulty. This can be easily seen from the chart as the + 1 diopter lenses would practically lower the zero horizontal line and the diagonal one step, so that when exercising two diopters of accommodation she would have to exert her utmost limit of convergence to see at one-third meter. Clearly — 1 diopter would have been much more serviceable. I ordered her simple abducting prisms (— 1° diopter)* for constant use. These have been quite satisfactory in relieving her of pain and what is perhaps better evidence of their benefit, the puffiness of the lids and the conjunctivitis have disappeared and show no tendency to recur. The abducting prisms ordered just brought the diagonal within the shaded area of comfort."

Figure 2 affords data not only of academic interest but also of much practical value. With a divergence of two meter-angles the person under test could develop two diopters of accommodation. With visual axes parallel she could get about 3.5 diopters of accommodation as a maximum with a negative relative accommodation, found by the use of convex lenses, of zero within the range of 0 to — 2 meter-angles of convergence. Such data, which are found frequently enough, do not argue for the general use of prisms, base-in, as a means of disclosing greater hyperopia (latency) or less myopia (spasm of accommodation) and do not support the idea of the prevalence of a so-called convergence-accommodation, although this condition may exist. Furthermore, with fixation at 33 cm. the positive amplitude of accommodation is satisfactory, but the minimal accommodation, or the amount of plus lenticular power that the eyes will accept, is about 1 diopter. In normal conditions, as shown in Figure 1, the amount of convex lens power that can be added when fixation is at 33 cm. amounts to 2.5 diopters, whereas the maximal accommodation is 7 diopters. In so far as the breadth of fusion is concerned, the chart (Fig. 2) shows that the total range of convergence with 3 diopters of accommodation in force is 5 meter-angles, of which 4 meter-angles are negative and 1 meter-angle positive convergence. This is outside of the normal ratio. Percival is correct, therefore, in asserting that prisms, base-in, are called for in order to shift the diagonal to the left or, in other words, in order to relieve the function of positive convergence by allowing the eyes to assume a position of rest. Still this is not the natural position of rest, which is slightly divergent. However, it is a better procedure, I believe,

*Practically O. U. 2 prism diopters, base-in.

to find the extra-ocular muscle imbalance at the reading point (33 cm.) using a test object, such as a line of type on a card, which demands an accommodative change of 3 diopters, although a greater or lesser amount of innervation may be actually demanded in order to produce the dioptric change. Then the values of the positive and negative fusional reserves may be obtained using a vertical row of letters printed on a suitable card. From such data, accepting the principle that the demand on any given function of convergence, whether it be positive or negative, must not exceed a half to a third of the fusion reserve, prisms of an amount sufficient to enable the act of binocular single vision to take place comfortably may be prescribed. In a general way, it is true that the procedures advocated either by Percival or by me will lead to comparable conclusions in practical routine anomalies of the motility of the eyes. In any event, both procedures will work toward the economical and efficient co-ordination of the ocular functions and this means comfort.

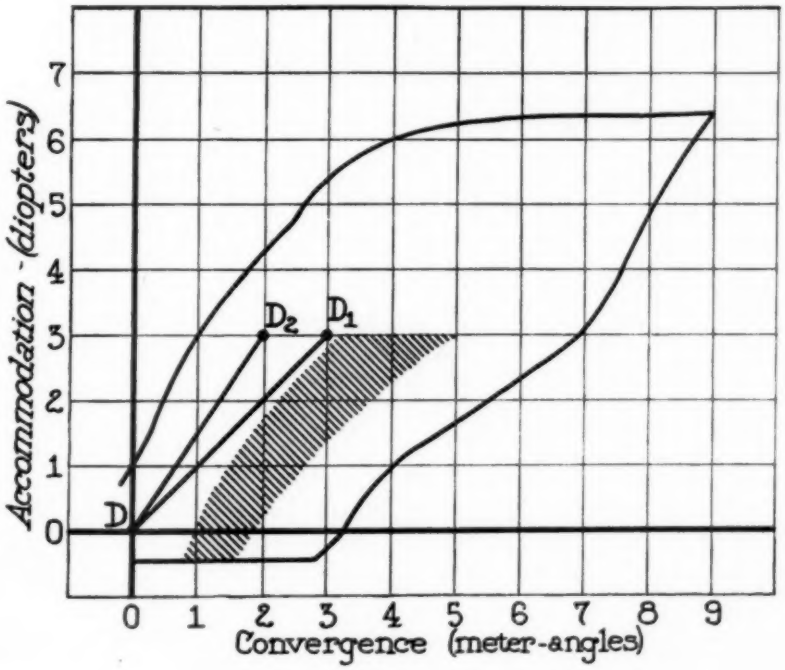

FIG. 3

Fig. 3. Curves of relative accommodation and convergence in the case of a person having excessive convergence (esophoria). The line of equal accommodation and convergence lies wholly to the left of the area of ocular comfort.

Figure 3 shows a condition of extra-ocular muscular imbalance reported by Percival quite the reverse of the conditions depicted in Figure 2. This is the chart of a man, aged 29 years, with 0.5 diopter of

hyperopia. There was with fixation at 6 meters no abduction but an overconvergence of about 3 meter-angles. At the 33 cm. point of fixation, the relative negative fusion was 2 meter-angles and the relative positive fusion was 4 meter-angles, with a total convergence of 6 meter-angles. Applying Percival's principle of area of comfort it is obvious that the diagonal, DD_1, lies outside of the area specified and to the left of it. In his discussion of this condition Percival[7] said: "At first, finding that he had 7 diopters of accommodation, I thought that reading glasses ought to be quite unnecessary, although he had obtained some relief from wearing + 1 diopter reading glasses. The chart explains this observation, for on lowering the horizontal line one step. it is seen that the summit of the diagonal would be in the center of the area of comfort, being at the point of intersection of 2 of accommodation and 3 of convergence. This case undoubtedly ought to have been given squinting exercises or exercising prisms to increase his convergence range, but as he absolutely refused to undertake orthoptic exercises I gave him adducting prisms of 1° d., associated with a correction of his refractive errors. The result has been completely satisfactory; although I feel sure that, with exercise, it would have been unnecessary for him to wear glasses at all. It is clear from the chart that if immediate relief were required, adducting prisms of 1 meter-angle (+ 1° 43′) should have been ordered, but part of the esophoria was intentionally left to be corrected by the patient's own efforts."

With some of these statements I am in agreement and with other expressions of opinion I am not in accord. From the data, as I view them, there is much evidence in favor of the use of considerable amounts of convex lens power rather than the simple use of prisms, base-out. The data on the relative accommodative ranges at the 33 cm. point of fixation indicate 2 diopters of probable ultimate relaxation of accommodation. A total range of accommodation of 6 diopters in the case of a person approximately 30 years old is much below what would be expected normally; the negative relative accommodation is high and the positive relative accommodation is low as compared with normal conditions at the age of 30 years. These facts argue for the statement that a considerable portion, if not all, of the esophoria is due to overstimulation of the innervation of the ciliary muscle. Excessive accommodative innervation is called for in order to accomplish the act of accommodation, and the condition of affairs is that which Percival refers to as squint of an accommodative character. In such conditions as this it would seem desirable to prescribe initially as much convex lens power as possible combined with small amounts (O. U. + 2 prism diopters) of prisms, base-out, and to follow periodically with attempts to increase the convex lenses, thereby reducing the esophoria and finally co-ordinating accommodation and convergence. It is possible that, in such conditions as those

under discussion, small amounts of prisms, base-out, will be needed permanently; but I am sure that there are more instances in which they should be removed after the proper (ultimately accepted) lenses are prescribed than most of us imagine possible. Exercises with prisms in such conditions I believe largely valueless; it is possible that gymnastic exercises, if persisted in, may help build up abduction. I believe in the use of prisms, base-out, only in exceptional cases and would recommend their removal if better co-ordination of accommodation and convergence occurs under the constant wearing of lenses correcting the refractive errors.

Fields of Accommodation and Convergence

Too much time is consumed and it is too arduous a task to get the full data on the relationships between accommodation and convergence as shown in Figure 1, except in rare instances. Furthermore, as a matter of ordinary refractive routine it is necessary only to get data at two points of fixation, 6 meters and 33 cm.; the relative ranges of accommodation and convergence at these two points furnish adequate information regarding asthenic or sthenic conditions. The routine of procedure may be summarized in these statements:

1. Correct all errors of refraction and determine the relative ranges of convergence for zero accommodation by means of abducting and adducting prisms, the test object being at a distance of not less than 6 meters.

2. Determine the relative positive and negative amplitudes of accommodation through the use of concave and convex lenses.

3. Repeat tests with the fixation object at a distance of 33 cm. These data give the relative ranges on both sides of the point corresponding to 3 diopters of accommodation and 3 meter-angles of convergence.

If the statement is accepted that the normal or standard relationship between accommodation and convergence at the usual reading distance (33 cm.) is such that there is an accommodative exophoria of about 1 meter-angle,[11 13] then the presence or absence of about 4 to 6 prism diopters of exophoria at the reading distance will constitute the basis on which the examiner will determine whether or not discomfort may be attributed to the relationships found to exist between accommodation and convergence.

4. Determine the relative positive and negative amplitudes of accommodation with definite and distinct fixation at the 33 cm. point.

5. Determine the absolute maximum of convergence (the closest point of approach to the eyes at which binocular single vision persists) in order to determine if the range of convergence is about normal or is considerably restricted.

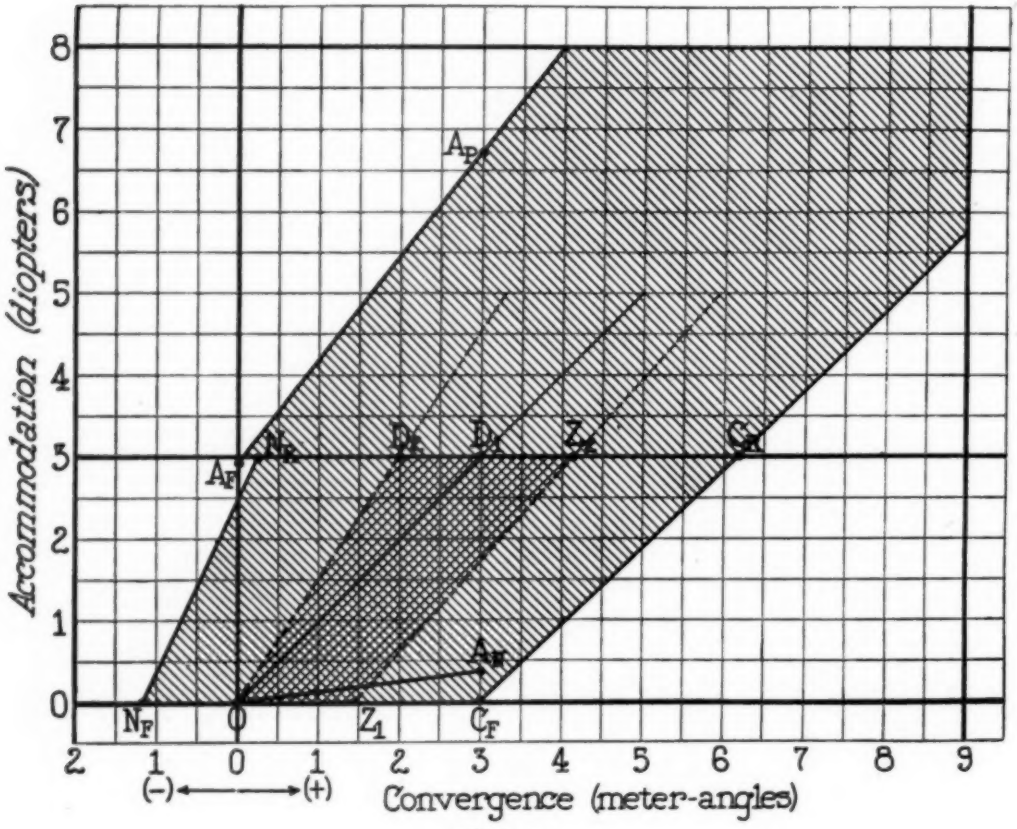

FIG. 4

Fig. 4. Chart outlining the fields of accommodation and convergence with data which show the relative ranges of accommodation and convergence for points of fixation at 6 meters and 33 cm. from a normal (standard) pair of eyes. The significance of the symbols is:

O—Center of co-ordinates; also negative relative accommodation at 6 meters.

Af—Positive accommodation (minus lens) at 6 meters.
Ap—Positive accommodation (minus lens) at 33 cm.
An—Negative accommodation (plus lens) at 33 cm.
Nf—Divergence or abduction (prisms, base-in) at 6 meters.
Nr—Divergence or abduction (prisms, base-in) at 33 cm.
Cf—Convergence or adduction (prisms, base-out) at 6 meters.
Cr—Convergence or aduction (prisms, base-out) at 33 cm.
OD_1—Line of equal accommodation and convergence.
OD_2—Line of accommodation and convergence with the balance at the reading point indicative of 1 meter-angle (6 prism diopters) of accommodative exophoria.

$O D_2 Z_2 Z_1$—Area of comfort as proposed by Percival.

Figure 4 illustrates the manner in which data, which are obtainable by the procedures I have outlined, may be plotted and from which the examiner may determine quickly and accurately the strength or weakness of either accommodation or convergence as well as the inter-relationships between these functions controlling distinct and single binocular vision. The data plotted in Figure 4 are representative of a normal, or standard, pair of eyes for a person 20 to 25 years of age and show adequate relative amplitudes of accommodation, no extra-ocular muscular imbalances (orthophoria) at the 6 meter point of fixation, 5 prism diopters of exophoria at the 33 cm. point of fixation, and ample positive and negative fusion reserves. The shaded area, therefore, represents that which may be termed the zone of relative accommodation and relative convergence. The area of comfort, as denoted by Percival, is shown by cross-hatching as O D_2 Z_2 Z_1 with respect to two points of test, 6 meters and 33 cm. The line OD_1 which represents equal accommodation and convergence, lies well within this area, whereas the line OD_2 which indicates orthophoria at 6 meters and 6 prism diopters of exophoria at 33 cm. constitutes one of the boundary lines of this area.

It will be found conducive to accuracy of diagnosis and a valuable guide to subsequent treatment if those interested in these matters will have printed in considerable quantity a chart such as that shown in Figure 4 and of a size, for example, 5 by 8 or 4 by 6 inches, which can be filed with the history of the case and other data obtained during ocular testing. These cards should be printed in black ink and the data acquired in the examination of any pair of eyes should be recorded on the charts in red ink. In this manner a full pictorial record is at hand and the data thus plotted may be compared immediately with those which may be considered reasonably standard or normal.

Points Concerning Defects in Convergence

Percival[7] stated four conclusions relative to the treatment of defects in convergence.

1. "Always correct hyperphoria and all refractive errors before testing for this type of heterophoria [convergence defects]." With this dictum I judge most, if not all, readers would agree.

2. "Never correct unless symptoms call for it." This statement I believe is to be called into question seriously. Symptoms alone do not constitute a sufficient basis on which to judge the necessity for prismatic assistance. I believe that the law of supply and demand is just as applicable to ocular functions as to the functions of financial institutions and business in general. With low liabilities and high assets, logic would lead one to conclude that no assistance was necessary. If the ratio between assets and liabilities, however, in the mat-

ter of relative convergence functions is less than 3 : 1 or, as a limit, 2 : 1, I believe that assistance should be given in order economically and efficiently to co-ordinate the function of accommodation and convergence. The possibility of discomfort is not the only consideration; decided exophoria or esophoria may exist with no complaints on the part of the person examined for the reason that binocular single vision does not exist. The condemnation to monocular vision with comfort can hardly be regarded as the best procedure if binocular single vision can be elicited and maintained with comfort through the use of prisms which many speak of, quite properly, as crutches. Any form of spherical, cylindrical or prismatic lens, or any combination of them, constitutes a visual crutch. When prisms are needed, they are needed badly; when they are not needed, they are worse than useless. My own opinion is to the effect that prisms, base-out, are generally of little service; prisms, base-in, are not infrequently necessary; prisms, base up or down, in conditions of vertical imbalance are definitely called for when the amount of vertical imbalance is 1 prism diopter or more.

3. "For esophoria give Min. + ⅓ Rc. For exophoria give Max. — ⅓ Rc. The symbols Min. and Max. are to be understood as meaning the *relative* minimum and the *relative* maximum convergence found at the distance for which the glasses are to be used." I believe that it is unphysiologic to lay down any such rule. As a first approximation to the truth, however it may be of service.

My objections are best indicated by citing an illustrative set of data which is virtually the same as the set given by Percival[7]. With the test object, an engraved line, held at 30 cm. the divergence is found to be 4 prism diopters and the convergence 20 prism diopters. The total convergence (R) with fixation at 30 cm. is 24 prism diopters or approximately 4 meter-angles. Following Percival's principle, the area of comfort will be between 4 and 12 prism diopters of positive relative convergence. The convergence, so Percival argues, required for reading lies 2 prism diopters to the left of the area of comfort and therefore 2 prism diopters, base-out, would be prescribed as the smallest correction that would relieve the patient. In my opinion, prisms should not have been given under such conditions. The prescription should be for the maximal convex or minimal concave lenses which could be prescribed in the light of other data, such as accommodative resources, accommodative suppression and so forth. Such lenses would induce relaxation of the apparent over-convergence or assumed esophoric condition.

4. "If the relative convergence range is defective, squinting exercises should be enjoined in exophoria; exercising prisms (abducting) in esophoria." I venture to say that there are almost as many opinions regarding ocular exercises, their character, their frequency, their

modus operandi, and so forth, as there are individuals who hold any opinions on these matters. Some argue for gymnastic exercises, while others advocate exercising with prisms from the trial case, phoroptors, kratometers, or myoculators. Some believe that exercises in all conditions of inco-ordination of accommodation and convergence are to be indulged in; others swing as far the other way and consider them ineffective because patients will not carry on with a program of proposed ocular exercises at home. Furthermore, they do not believe in a routine of administration of such exercises under their supervision on the basis that they are not likely to produce beneficial results. In my opinion, exercises may be of value only in conditions fundamentally dependent on weakness of positive convergence. Exercises in conditions of vertical imbalance and in esophoria are not, in general, of value. There is no material stimulus to divergence (overcoming an over-convergence) but such a stimulus does exist in convergence, which is a positive action and which must exist if binocular single vision obtains at points close to the eyes.

In conclusion, the correction of refractive errors, if the errors are of a high degree, may cause a profound alteration in the relative activities of the nervous centers controlling accommodation and convergence. Innervation may be suppressed or inhibited or, again, it may be called into play to a greater extent than previously. Many individuals have the ability to adapt themselves to the new conditions set up by the correcting lenses and temporary inconvenience only is produced. Unless there are evidences of decided inco-ordination of ocular functions it is good practice to prescribe lenses correcting only the refractive errors and to omit prismatic corrections except in conditions of vertical imbalance. Subsequent examinations, within a period of three months, should then disclose whether functions are in weakness or strength as well as the character and amount of the excess or deficit. From a consideration of all the data thus obtained, logical conclusions regarding the necessity of prismatic assistance can be drawn.

Summary.

1. Conditions of ocular discomfort which have not responded to the correction of refractive errors are encountered frequently.

2. The causes of this ocular discomfort may reside in either weakness or deficiency of accommodation or convergence, or in a combination of both.

3. Data should be obtained regarding the relative amplitudes of accommodation and convergence at distant (6 meters) and close (33 cm.) points of fixation as an integral part of every routine refraction.

4. Relative amplitudes and ranges of accommodation and convergence only should be considered, since the absolute range of convergence is not involved primarily.

5. The criterion of Landolt to the effect that not more than a third of the absolute range of convergence can be exercised continously without fatigue should be questioned.

6. The criterion that not over a fourth to a third of the amplitude of relative convergence can be employed continuously and with comfort appears to be substantiated by practical experience.

7. The imbalances of the extra-ocular muscles, discovered by dissociation tests, do not constitute, in and of themselves, a sufficient basis for the prescription of prisms.

8. The laws of supply and demand are as applicable in conditions of ocular weakness, whether this be in accommodation or convergence, as in other problems involving elements of weakness and strength. The liabilities must be considered in the light of the reserves which are displayed under test.

9. The conception of a zone of comfort, as portrayed by Percival, is a valuable one in the consideration of the causes and remedies for ocular discomfort.

10. Data regarding the liabilities and reserves of accommodation and convergence can be obtained readily for far and near points of fixation and may be plotted on a chart, such as that shown in Figure 4. Deviations from the standard conditions and departures from the zone of comfort may be determined and may serve as guides in the prescription of prisms, of muscular exercises or of a combination of both.

11. Prismatic assistance in cases of vertical imbalance is important and should receive careful consideration in all conditions which consistently show an error of 1 prism diopter or more.

12. Prisms, base-in, are frequently needed, since weakness of convergence is not uncommon. Prisms, base-out, are rarely of any value and should be used ordinarily only as temporary alleviators and until such time as the over-convergence responds to proper suppression of the excessive accommodative innervation, which is probably the cause of the esophoric condition.

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OCULAR ELECTROTHERAPY

J. I. Kurtz, B. S., A. O., F. A. A. O.
Minneapolis, Minn.

CHAPTER XIII.

Diathermy Technique

1. Block Tin,
2. Flexible Mesh,
3. Metal Discs,
4. Non-vacuum Electrodes,
5. Auto-condensation Pad.

The block tin, flexible mesh and non-vacuum electrodes have been described in the preceding pages. The metal disc electrode is made up of round metal discs varying in diameter from ¼ of an inch to 2½ or 3½ inches. The larger sizes of these metal disc electrodes are not of much practical value, because of the fact that they being solid and flat, do not easliy conform to the shape of the body which is mostly spherical. These metal disc electrodes are fastened to an insulating handle and are to be held firmly to the place applied so as to make even contact.

Auto-condensation pad is made of a sheet of metal 5 to 6 feet long and 1 or 2 feet wide. This is attached upon a table and is covered with insulating material. The patient is to lie down upon this covered metal sheet, holding a metal bar in his hands. There is also an auto-condensation chair pad, this is made up of two small sheets of metal held together with a set of hinges and is made up in such a way that it will fit into the treatment chair as illustrated in figure 20. The patient can be given his treatment in a sitting position.

Diathermy Application

There are two methods of applying diathermy:

1. Direct,
2. Indirect or modified.

The direct method is used when both electrodes are applied directly to the place treated. For instance, if the elbow or knee is to be treated, one electrode formed in a cuff-like shape is placed above and the other below the place to be treated, the heat is then evenly distributed through the effected place, providing, of course, that both electrodes are of equal size.

The indirect method is used when both electrodes are not applied directly to the place treated, for instance, like in the application of auto-condensation where only one small electrode is applied to the

Fig. 20—Auto-condensation Folding Chair Pad.

place to be treated and the other is placed under a di-electric or insulating covering of sufficient insulating strength to prevent the passage of any of the current through it. The electrode under the insulating covering is usually made up of a sheet of metal which is about the same length and breadth of the patient. The electrical phenomenon of this method is somewhat similar to the action of a leyden jar. The large electrode under the cover acts as one coating of the leyden jar and the patient the other, and the insulating covering takes the place of the glass of the jar. The large metal electrode is charged positively at one surge of the electric current and the patient by induction is negatively charged and the next moment the process is reversed and the patient is positively charged from the circuit and the electrode receives a negative charge by induction. The whole body heats up gradually under this method, the heat, of course, is the greatest nearest the smaller electrode. The indirect method of diathermy may be applied to the eye in this manner. The patient is to sit in a chair having a folding auto-condensation pad upon it, this pad is used as one of the electrodes which is connected to one of the D'Arsonval terminals of the High Frequency machines. For the second electrode, a non-vacuum electrode or a piece of woven mesh about 1¼ or 1½ inches wide and long enough to reach from the outer cantus of the right eye to the outer cantus of the left, is connected up to the other D'Arsonval terminal and is applied directly over the eyes. The current may be grounded through the operator's arm and body. In applying this indirect method, the current does not surge straight through the body tissues and body electrodes from

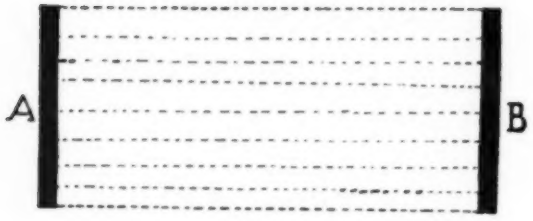

Fig. 21—Both Electrodes A and B are the same size.

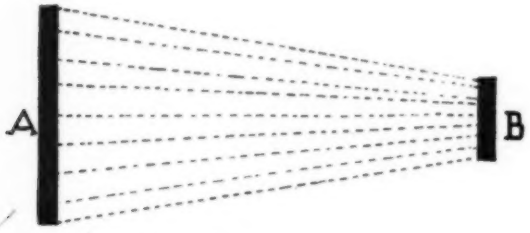

Fig. 22—The Active Electrode B is smaller than A.

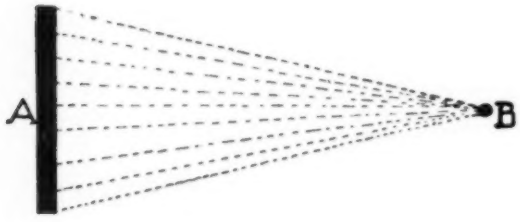

Fig. 23—The Active Electrode B is much smaller than A.

one side of the body to the other as in direct diathermy, but simply enters and fills the condenser electrode and induces or repels charges back and forth at the distal surface of the glass. In using the non-vacuum tube in indirect diathermy, three techniques may be used, namely:

1. Sedative Technique,
2. Stimulative Technique,
3. Counterirritant Technique.

The Diathermy Sedative Technique

In applying this technique, the current is to be turned on very slowly and gradually up to the tolerance point of the patient and then lowered slightly. In no case should one use more than 100 milliamperes per each square inch of active electrode if he wants to

stay within the safety limit. At least five minutes should be spent at the beginning of the treatment in gradually turning on the current to the tolerance point of the patient. In no case should the milliamperage be doubled in strength at one time, but should rather be worked up to the desired strength slowly. This technique may be varied considerably. It may be used with an auto-condensation chair pad as one of the electrodes and a non-vacuum tube as the other, the part to be treated is to be placed on the chair pad and the other electrode is placed on the opposite side. It should have good contact with the part under treatment. Again, in place of the chair pad another non-vacuum body electrode may be used or a piece of block tin may be used as the inactive electrode and the non-vacuum tube or a piece of woven mesh as the other. When the treatment is terminated the current should *not* be shut off abruptly. It should be decreased in strength gradually over a period of at least 1½ minutes. By the end of this time, the spark gap is to be completely closed and the milliamperage should be reduced to zero. *The rule for the application of the sedative technique should be to increase the milliamperage slowly at the start of the treatment and to reduce it gradually at the end of the treatment.*

The application of the sedative technique according to Sampson[49] results in an intense arterial hyperemia. This hyperemia produces an increased metabolism in the part under treatment by dilating all blood vessels, by opening up lymph channels, activating phagocytes as well as increasing their number in the area. These very rapid oscillations in traveling through the part produce a vibratory effect upon each molecule, atom and electron. The passage of a high speed stream of electrons or oscillations through abnormal tissues results in a general resumption of activity by many cells that have previously been inactive.

The Stimulative Technique

This technique is applied in cases where it is desired to stimulate the part to be treated. In this case, the current is turned on and off rapidly by opening and closing the spark gap abruptly. The treatment under this technique is short and vigorous and its object is to irritate the tissues and provoke reflex action. Cramped muscular conditions often follow this form of treatments.

The application of the sedative and stimulative techniques are about the same up to the point when the current is to be turned on. In the first case, the spark gap is opened slowly and the current increased gradually and in the second case the spark gap is opened very rapidly to the fullest extent. The current is to pass from four to six minutes and is then shut off abruptly. The milliamperage applied in the stimulative technique is to be about one-fourth or less of that used in the sedative treatment.

Counterirritating Technique

In applying this technique more current is to be turned on

than under the stimulative technique, the spark gap is opened wide until a shower of sparks passes when the electrode is approached to the skin. The electrode is to be passed up and down over the area to be irritated, it is to be held far enough away from the skin so that a continuous shower of sparks will pass. The electrode is to be moved rapidly as the sparks are intolerable if applied at one place for any length of time. Care should be taken to turn the edge of the electrode so that a different part comes into use with each change. This precaution must be taken because the part of the vacuum electrode in use becomes very hot and is liable to crack if one part of the electrode is used through the entire treatment. For the same reason, care should also be taken not to lay the electrode down on a marble or metal surface immediately after it has been used. In discussing the application of diathermy, Sampson[49] gives fourteen points which are of interest. They are as follows:

1. *Selection of Method* of applying the diathermia whether direct, indirect or modified and, if direct, choice of the double cuff, double plate or cuff and water method.
2. *Technique*—sedative or stimulative.
3. *Selection of Proper Electrode Material.* (Same for both techniques.)
4. *Proper Preparation of Skin and Electrodes.* (Same for both techniques.)
5. *Proper Application of Electrodes.* (Same for both techniques.)
6. *Use of Elastic Bandages.* (Same for both techniques.)
7. *Beginning of Treatment.* (Differs in the two techniques.)
8. *Timing of Treatment.* (Differs in the two techniques.)
9. *Proper Use of Spark Gap.* (Differs in the two techniques.)
10. *Terminating Treatment Properly.* (Differs in the two techniques.)
11. *Calculating Dosage.* (Differs in the two techniques.)
12. *Knowledge of Basic Laws that Apply.*
13. *Knowledge of the Effects Produced in Tissues by Each Technique.*
14. *Knowledge of Indications and Contra-indications for Each Technique.*

Dosage Applied

In applying diathermy it is important that one should know the basic laws that apply in calculating the amount of current applied through the electrodes.

The Density Varies Inversely as the Area

The density of the current means the number of electric units passing through a given unit of area. That is, if the electrode is

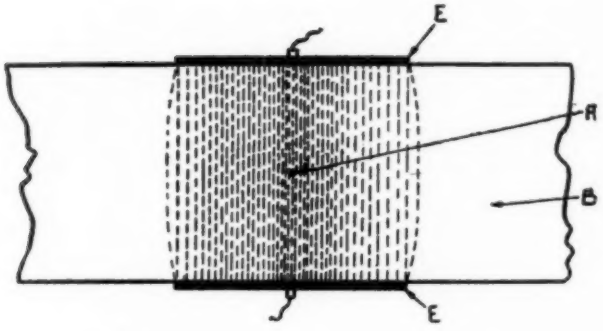

Fig. 24—Heat effects of a uniform mass lying between electrodes; EE, Electrodes; B, lines of force; A, area first to become heated. (Courtesy B. B. Grover.)

four inches square, it has an area of 16 square inches, or if the electrode is 6 inches square, it has an area of 36 square inches.

Now, if 360 milliamperes were applied, then each square inch of the larger electrode would carry 10 milliamperes and when the smaller electrode is used each square inch in the smaller electrode would carry more than double this amount of 22.5 milliamperes to be exact. We can feel safe that no blisters or burns will result from the diathermy application if we figure that the density of the current varies inversely as the area and keep in mind the rule mentioned previously, that not more than 100 milliamperes should be allowed to pass through one square inch of active electrode. Of course, the operator must know the condition of his set and the amperage meter because the meters of one machine may vary the reading considerably when placed in another machine even though the factors of resistance, spark gap, etc., are the same. It is also claimed that the quality

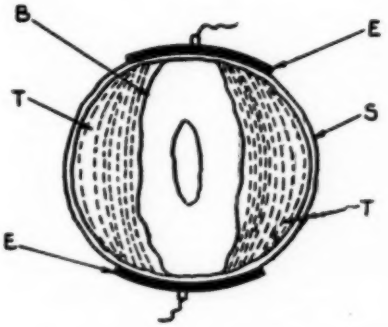

Fig. 25—EE, Electrodes; S, Skin; T, Soft Tissue; B, Bone; When bone extends from electrode to electrode and surrounded by soft tissue, the current follows the soft tissues and is first to become heated. (Reproduced from Grover.)

of the current has something to do with the amount of heat produced. This would be due to an increased wattage carried by a higher voltage, traversing higher resistances, which are limiting the milliamperage to the same figures.

We also must bear in mind that *the effects of heat currents vary as the square of the amperage, i. e., if a milliamperage of 300 is used and this is increased to 600, the milliamperage reading is only doubled but the effects have been increased 4 times, or 2 square inches.* This holds true theoretically, but not when applied to living subjects, because claims Grover that when strong currents are employed, the body reflexes are stimulated to such a degree that all functions which regulate heat in the body, are stimulated to combat heat from the outside. This is not so when weak currents are applied. Here the reflexes are not stimulated and the current is thus allowed to get by.

Size and Position of Electrodes

The amount of heat delivered at a certain point is largely dependent upon the position and size of the electrode. The heat is more concentrated nearer the smaller *active electrodes.* When the two electrodes are of the same size, the greatest amount of heat will be midway between the two. Figures 21, 22 and 23, respectively, illustrate the current concentration (a) when both electrodes are of the same size (b) when one is slightly smaller than the other 3 (c) and when one is considerably smaller than the other.

The position of the electrodes are also an important factor in the heat distribution of a diathermy application. If the two electrodes are placed opposite each other, the current will pass in a straight direction lying between the two electrodes. The current is evenly distributed in the path between two equal sized electrodes placed opposite on a mass of homogenous material as illustrated in Figure 24. The path of the current is entirely different when it passes through a mass which is not homogenous. Focusing the heat in this case becomes more difficult as the current tends to pass around the bone tissues which offer greater resistance than the soft tissues. However, if the treatment is continued for a considerable length of time, say half an hour or more, and if the voltage is sufficiently strong enough, the current will gradually pass through the bone and it will become heated up. The bone once heated, retains the heat much longer than any of the other tissues.

Figure 25 illustrates the path of the current passing through a mass which is not homogenous when both of the electrodes are of equal size and are placed opposite to one another. When the electrodes are placed in a position so that they are not opposite one another the path of the current is different, and the heat distribution is also different. Figure 26 illustrates the point.

This is one of Dr. Grover's experiments.[50] The material used is

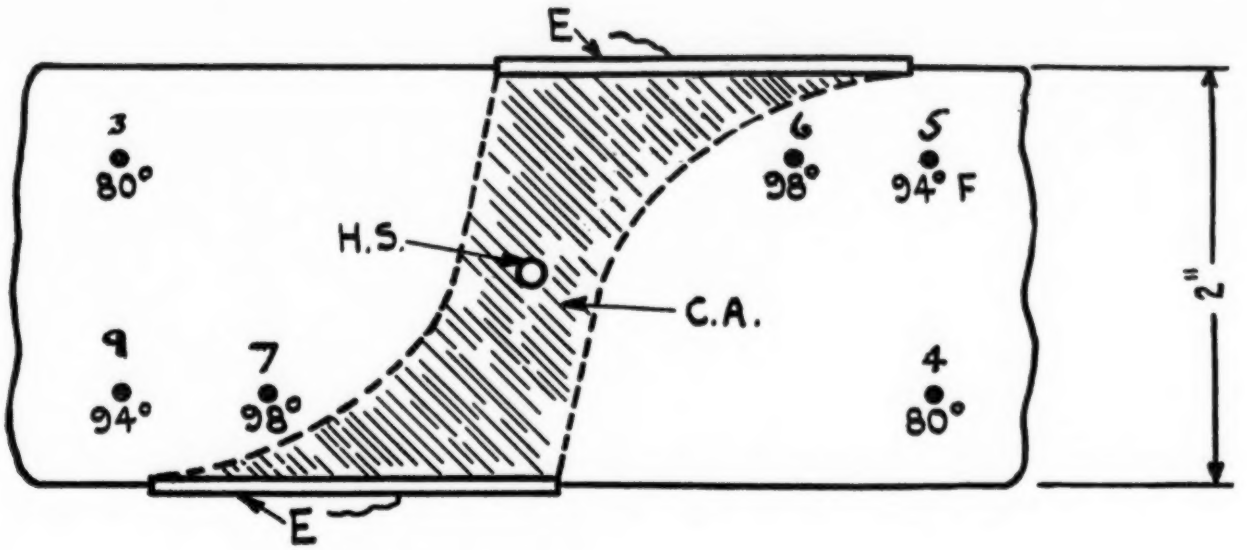

Fig. 26—Graphical illustration of path of the current when electrodes are placed so that the approximate edge of one electrode is directly opposite the distal edge of the other. (Reproduced from Grover—actual size.) 1, 2, 3, 4, 5, 6, 7, thermometers; H.S., Hot Spot; C. A., Coagulated area.

a piece of beefsteak, twelve inches in size and two inches thick. The electrodes are placed one on each side of the mass in such a manner that the approximate edge of one electrode is directly over the distal edge of the other. The peak voltage in this experiment is approximately 8,000, the amperage 1,200, frequency 1,600,000, resistance low, time, 35 minutes. He placed seven thermometers within the mass as follows: No. 1 center, opposite approximating edges of electrodes; Nos. 2 and 5, in mass one-half inch from distal edge of electrodes; Nos. 6 and 7, one-half inch from the center of each electrode; Nos. 3 and 4, in mass one and one-half inches from distal edges of the electrodes.

Diathermic Massage.

This technique particularly applicable in ocular work. The technique in general described by Turrell[51] is as follows: The patient is placed on an auto-condensation couch and connected up in an ordinary way and a current of about 250 milliamperes is turned on, the operator places his fingers over the painful area and keeps on massaging that place. This draws the current from the patient and concentrates the heat effects in the painful area. When the operator moves his fingers, there is a combined effect of diathermy and massage.

DR. J. I. KURTZ,
209 MEDICAL ARTS BLDG.,
MINNEAPOLIS, MINN.

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THE SIGNIFICANCE OF THE TAIT DYNAMIC SYSTEM IN MYOPIA*

George A. MacElree, Jr., Opt. D.
Philadelphia, Pa.

With the advent of Dr. Edwin Forbes Tait's exposition of his original technique and interpretation of Dynamic Skiametry, Optometry has had placed in its fund of knowledge a most practical method of determining the true refractive power of the eye. Prior to this time, numerous methods for obtaining this desideratum have been presented by both non-medical and medical refractionists. These methods have usually been offered as a panacea to dispel all doubts arising over the ultimate prescription; only to prove themselves mirages under the cold light of both clinical and office practice. As stated by Dr. Tait in his article in the December issue of the American Journal of Optometry, the Tait Dynamic System has not been offered haphazardly; but instead is the result of much research and experimentation, both in the Clinics of the Pennsylvania State College of Optometry and the practices of numerous Optometrists in Philadelphia and elsewhere. In the writer's personal knowledge this work has extended over a period of at least five years.

The purpose of this article is not to merely indulge in laudation of this method of refraction but to illustrate its applicability in cases of myopia. In all Dr. Tait's articles and lectures to date, he has stressed the value of the System in cases of hyperopia and hyperopic astigmia, ignoring its part in guiding the treatment of myopia.** The originator of this method has not done this with any purpose of intended omission but rather from the standpoint that the System should first be mastered as a whole before any attempt is made to apply it to any particular type of case. The present writer strongly concurs with this opinion, and offers this article only in the sense of a sequel to the orginal article. He particularly warns the reader that a thorough mastery of the System, in theory and practice is assumed; as well as the possession of the proper skiascope developed for the technique and without which any use of the System is not only inaccurate but absolutely futile.

It has long been acknowledged that the difficulty encountered in myopic cases lies in the determination of the amount of true myopia. Present day Optometric science has revealed the danger of regarding myopia as a fixed error of refraction, requiring only a cor-

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**[During the year 1929 Dr. Edwin Forbes Tait has done much work on the subject of Dynamic Skiametry in Myopic cases and at the Annual Sessions of the American Academy of Optometry presented a paper on this subject which will be published in this Journal at a later date.]—Editor A. J. of O.

rection with minus lenses. In order to emphasize the particular value of the System it will be necessary to review the present status of the treatment of myopia.

Authorities today are practically unanimous in their endorsement of the theory that myopia is usually of a two-fold nature. Thus when a case of myopia presents itself for our study we are actually confronted with two varieties existing simultaneously. To these types the following definitions have been given:

Organic myopia is that produced by an increase in the anterior-posterior diameter of the eye, causing the focus in the hitherto normal eye to fall in front of the retina. This has also been termed: Axial myopia.

Functional myopia is that produced by a shortening of the radius of curvature with a corresponding increase of the dioptric value of the surfaces of the crystalline lens, causing the focus in the hitherto normal eye to fall in front of the retina. This has also been termed: Lenticular Curvature myopia.

It is readily apparent that of these two types the second only is amenable to treatment. At present it is impossible to restore the axis to its normal relationship to the focal length by shortening the eye. Numerous experiments attempting to use the extrinsic muscles to accomplish this have been conducted; but a real precentage of success has not been obtained. If the myopia is of the second type, however, it is not beyond the means of Optometry to relax the over tensed intrinsic muscle which is producing the increased lenticular curvature.

Myopia caused by a variation in the refractive indices of the intra-ocular media has generally been classed as indicative of systemic pathology and represents the causative factor in a very minor number of cases. For these reasons it will not be discussed in this paper.

Probably the best attempt made to account for this dual condition is the current theory that all myopia starts primarily as functional and gradually changes to organic due to the sustained choroidal tension incident to the accommodative process. If this continues and more functional is caused we term the condition progressive myopia. Beyond doubt such conditions as heredity, unbalanced metabolism, etc., would have a particular significance in the individual case and not nullify the theory as a whole. Nothing serves better to produce an amount of functional myopia over and above the amount of organic myopia present, than an overcorrection with minus lenses. Probably the greatest tragedy of refraction is the numberless cases that have been started on the pathway of progression by an over zealous visual acuity enthusiast. The greatest number of these cases, we believe, are not due to this cause, but rather to an unbalanced accommodation-convergence relationship which must be corrected before the condition will be halted. If in a

case the amount of true organic myopia is obtained, and the prescription given in accordance with this data, all necessary orthoptic and constitutional measures adopted; the patient is well assured that the condition will at least remain in its present state and that the insidious progression will cease.

The query arises: How may we find the amount of the organic myopia in distinction from the amount of total myopia which may be revealed by both static skiametry and the subjective test? From time to time, a great many able minds have grappled with this problem and produced tests employing base-in prisms cross-cylinders and other methods of instrumentation. To date, all of these methods have been of a subjective nature, and against them rages the juggernaut which overthrows all subjective methods of sight testing—the patient's psychic bias. After the data has been obtained by these various methods, there exists an element of doubt in the refractionist's mind as to the verity of his fund of information. This is not meant in disparagement of any of the aforesaid subjective tests, but merely to show that the extent to which confidence may be reposed in their findings is very low indeed. Logically, the only difference lies in the obtaining of this data, for once it is found, the treatment of the case rests upon a very concrete and practical scientific basis.

The Tait Dynamic System affords the best method in existence today for calculating the amount of organic myopia. It may readily be understood that the functional myopia to which we have been constantly referring is merely ciliary hypertonicity. Employing this System, we obtain after the various allowances have been made, the actual amount of organic myopia. The deduction of this from the total myopia yields the amount of functional myopia, if it is desired.

There are a few peculiarities inherent to the employment of this dynamic system in myopia, which are quite worthy of our consideration. At this place a brief discussion of these will be in order.

The actual usage of the system in general refraction, involves the fogging of the patient with a rather high plus lens. Naturally, the myope does not require as high a lens to produce this effect as the emmetrope or hyperope. In cases presenting myopia of six diopters or over, we may dispense with the use of a fogging lens. The approximate correction for the astigmia of the eye, as obtained by the intelligent use of the Keratometer, and represented in minus cylinders, is introduced at the commencement of the test. If a plus lens is required to complete the fog, its power should be sufficient to produce a moderately slow against movement of the shadow. Since virtually every eye subjected to the system is rendered myopic for the time required to obtain the readings, the actual technique in myopia dos not differ essentially from that employed in any other anomaly.

The intensity of the fundus reflex seems a slight bit greater in

cases of myopia than in others. There is no sound theoretic reason for this, aside from the amount of light admitted to and emitted from the eye due to the size of the aperture. This brings into consideration the second point of difference—the size of the pupillary opening. It has long been sound clinical reasoning to expect small pupils in hyperopia and large pupils in myopia. This condition of pupillary enlargement, not only produces a more intense reflex, but endangers the veracity of the findings, due to false shadow movements arising from various zones of aberration. This should serve to further emphasize the teachings of all capable skiametrists to devote attention only to the shadow movement occurring in the exact center of the pupil. The variability of the color of the fundus reflex is a very exact clue to the position of the high point of neutralization. All observers have noted that when a moderate fog is placed before the eye, the reflex assumes a dull red character. As the lens power is reduced and the high point is approached the reflex acquires a greater brilliancy and quite a bit greater proportion of yellow. In myopia, this color phenomena is even more greatly accentuated, so it would actually be possible to obtain a fairly accurate dynamic skiametric reading in myopia, using only the reflex color fluctuations as a guide. This makes the stopping point somewhat easier of determination, as we have both the shadow motion and the color to base our fiindings upon.

In presbyopia with myopia, the same procedure may be used or the general non-fogging dynamic test employed. In this we simply deduct our static results from our dynamic findings to obtain the add. As this technique does not truly belong to the Tait Dynamic System it will receive only this brief mention in this article.

The actual determination of the high point of neutralization is not nearly as difficult as the interpretation of the results achieved. In myopic cases the allowance is the same as in other errors, and must be made in accord with the amount of physiologic exophoria present. The reader, of course, from his perusal of the article by Dr. Tait, understands that the deduction is not made for the physiologic exophoria, but rather for the underlying factors which produce such a condition. The Dynamic Table as given in both numerical and graph forms will be found of considerable aid in making the proper deduction; consequent to the true interpretation of the results obtained. For the sake of accuracy, it may be best to refer to the Dynamic Table whenever deductions are to be made; but after a short period of employment, it will be found that an unconscious memorization has taken place and the table will not be needed.

After conducting the various phoria tests and obtaining our deductions therefrom, we at last obtain the true or basic formula. Neither of these terms are quite correct in their application to our findings less deduction, but are used for want of a better word in our terminology. Now we come to the gist of the significance of the system in myopia, for by obtaining this true formula we have determined the amount of organic myopia present in the patient's

eye. It may be seen that by the use of this method we have entered upon the veritable heart of the problem of myopia. We know the actual amount of organic myopia present and by deducting this from the total myopia revealed by static skiametric and subjective methods we obtain the amount of functional myopia present. This very knowledge gives us a strong impetus towards the solution of the patient's visual problems. We know exactly how much of the myopia present should be amenable to treatment, for as previously stated only the functional type of myopia may be relieved by Optometric means.

We can also very easily determine the proper course of treatment to pursue for the alleviation of the discomforts of the condition, and the retardation and usually complete stoppage of the progression. As to the methods employed to reduce the amount of functional myopia to zero, we shall find as many routines as there are practitioners. In our experience at the Clinics of the Pennsylvania State College of Optometry we have found that a symposium of all methods has been productive of the best results. We have taken cases of all amounts and applied specific methods of treatment to them, such as bi-focals, base-in treatments, etc., and found they did not make as good time upon the road to recovery as the cases in which all known methods were employed. The final adoption of any method or methods is a matter of judgment on the part of the individual refractionist, the main considerations being that the Optometrist realize how much of the total myopia he can relax and how much cannot be diminished.

The following summary of a typical case may serve to clarify the situation in the reader's mind at this time. It has been extracted from the P. S. C. O. Clinic Record Library and contains only that information which is necessary for the consideration of this phase of the work. Approximately three-quarters of the report has been depleted, not from any sense of it being extraneous to the matter, but to avoid any befogging of the major factors involved.

E. M. K. Aet. 26. The history as given in the record is that of a condition of myopic progression. Numberless prescriptions over a few years, with complete satisfaction for the first few months, followed by a gradual fogging and discomfort until the next prescription, and the same experience. The data obtained from the external examination was normal as was the ophthalmoscopic inspection, save that a minus four lens was necessary to obtain a clear view of the fundus. The corneal astigmia was:

O. D. .75 WR 90/180
O. S. 1.50 WR 90/180

A dynamic skiametric test was next employed using the Tait technique and the high point of neutralization obtained with the following prescription placed before the patient's eyes.

O. D. + .25 Sph. ⊃ — .50 cyl. ax. 180
O. S. + .50 Sph. ⊃ — 1.00 cyl. ax. 180

From these findings was deducted the physiologic allowance of 1.50 diopters for a refracting distance of thirteen inches. This gave us the approximate prescription below:

O. D. — 1.25 Sph. ⊂ — .50 cyl. ax. 180
O. S. — 1.00 Sph. ⊂ — 1.00 cyl. ax. 180

Placing this Rx before the patient's eyes, the tonicity tests at both distance and near were taken and the physiologic exophoria calculated. The following data was obtained:

Distance 3Δ Esophoria
Physiologic Exophoria 10Δ
Near 13″ 7Δ Exophoria

Upon using the Dynamic Table we at once find that in cases presenting 10Δ of physiologic exophoria we must make an additional allowance of .50 D. from our approximate prescription. Upon doing this we obtain as our true or basic Rx:

O. D. — 1.75 Sph. ⊂ — .50 cyl. ax. 180
O. S. — 1.50 Sph. ⊂ — 1.00 cyl. ax. 180

The data as revealed so far indicates that here is a person possessing the above amount of organic myopia. This cannot be reduced and if this represents the sum of the myopia present we cannot hope to reduce it below its present reading. Let us now look at the data obtained by the other tests. Static skiametry and the subjective test reveal that a V. A. of 20/25 may be obtained with the following:

O. D. — 4.00 Sph. — 1.00 cyl. ax. 180
O. S. — 3.50 Sph. — 1.00 cyl. ax. 180

In contrast to this the visual acuity with the true Rx was a very poor 20/200. Using the method as outlined in this paper for obtaining the amount of functional myopia by subtracting the organic from the total we find the patient has:

O. D. — 2.25 Sph. — .50 cyl. ax. 180
O. S. — 2.00 Sph.

of functional myopia which should be relaxed as quickly as possible. The reason for the slight amount of induced myopic astigmia in the right eye will not be discussed at this time, as it would merely confuse the issue.

The case was put under a rigorous system of treatment and in noting the addenda made at an examination six months later, we find the dynamic findings remaining the same, showing that the progression has been halted for this length of time. A. V. A. of 20/30 is now obtained with:

O. D. — 3.00 Sph. — .50 cyl. ax. 180
O. S. — 2.75 Sph. — 1.00 cyl. ax. 180

The functional myopia has now relaxed until it is just about one-half its former amount. Treatment was still continued, since it was

realized that there was still more functional myopia to relax. The Rx which the patient is wearing today after a period of over a year, with a V. A. of 20/25 is:

O. D. — 2.25 Sph. .50 cyl. ax. 180
O. S. — 2.00 Sph. — 1.00 cyl. ax. 180

Lest this be taken as a very extraordinary case in which either the patient was the one-time victim of an over correction or a vacillation of the refractive indices of the intra ocular media, the author knows personally of at least one hundred similar cases on file at the Pennsylvania State College of Optometry's Clinic. However, quoting of any further cases would only serve to fatigue the reader.

From the above presentation of the salient facts concerning the operation of the Tait Dynamic System in myopia, these conclusions are inevitable:

If this method were universally adopted and its findings made the basis for rational treatment, nearly all the present day cases of myopia would be materially reduced. Some cases would no longer be myopic, but discard their glasses or wear slight plus corrections.

Rational treatment of a myopic case is very seriously handicapped, if the Optometrist does not know how much of the myopia is of a functional type and how much is organic in nature. It may be noted in the above case, that the myopia has been reduced within .50 diopter of the limit set by the findings of the dynamic test. When this limit has been reached, as it will be within a short time, the refractionist will realize that his best results have been obtained, and the treatment will now become more prophylatic in nature, to prevent functional myopia from again occurring in this case.

If a case should present itself in which the same data were obtained with the exception that the true Rx should prove the myopia to be entirely organic in character, the Optometrist would realize that the possibilities of reducing the condition are practically nil, and neither time nor reputation should be expended upon it. This one fact would, in our opinion, justify the inclusion of the Tait Dynamic System in the routine of refraction.

DR. GEO. A. MacELREE,
2813 N. FRONT ST.,
PHILADELPHIA, PA.

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EDITORIAL STAFF

DR. CAREL C. KOCH, Editor
209 Medical Arts Bldg.
Minneapolis, Minn.

DR. JACK I. KURTZ, Associate Editor
209 Medical Arts Bldg.
Minneapolis, Minn.

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THE MODIFIED DEAN OPHTHALMOSCOPIC TECHNIC

For a most painstaking examination of the media and fundus Dr. A. M. Skeffington of the Graduate Clinic Foundation recommends what he calls the Modified Dean Ophthalmoscopic Technic. This technic which he credits to Dr. Roy S. Dean, optometrist formerly of Duluth, Minnesota,* differs from most other ophthalmoscopic technics in several particulars, namely, the patient's position while the examination is made, the seemingly unusual fixation angle, the position and posture of the examiner as well as the method of holding and applying the opthalmoscope.

Skeffington claims the examiner can, by using this technic, make a much more detailed and thorough survey of the media and fundus than is possible by any other form of direct ophthalmoscopy and for this reason recommends its adaption by all optometrists.

In using this technic the examiner is enabled to search, says Skeffington, the entire posterior half of the eye globe and not be confined to the area immediately surrounding the nerve head and macula. If the right eye of the patient is to be examined, he is placed in a semi-reclining position in the ophthalmic chair at an angle of about 45 degrees, and his gaze directed toward a predetermined object on the ceiling, he will then, in effect, be looking straight forward on a line at right angles to the plane of the face.

Next, the left hand of the examiner is placed on the right side of the patient's face, the hand following the curve of the cheek

*Procedure in Ocular Examination. A. M. Skeffington, pp. 23-29. 1928.

bones. The curve of the little finger is placed just below the canthus of the eye, and the heel of the hand comes almost to the corner of the patient's mouth. The ring finger is then bent downward and placed on the exact top of the eye with the moon of the nail placed just at the point where the cilia joins the eyelid. At the same time the examiner's left elbow is drawn in close to his own body. The ophthalmoscope is grasped in his right hand, with the index finger extended up to the lens battery for convenience in changing lens power and the little finger curved outward to rest against the patient's chin or cheek. The left index finger is then bent on a right angle from the second joint for the reception of the ophthalmoscope, which is placed in the curve of this index finger, with the head of the instrument resting against the finger itself.

This being done and with the index finger held flexed, the entire left hand is moved upward, carrying the eyelid, until the finger rests on the frontal bone, holding the lid in place, allowing the patient to blink with the other eye as much as he wills, without disturbing the eye under observation.

The examiner, says Skeffington, leaning well forward over his reclining patient with both elbows drawn close to his own ribs, and with his head bent slightly towards his left shoulder, applying his eye to the opening of the instrument, will find his instrument automatically focused on the optic disc of the eye being examined. The vertical plane of the examiner's face will be paralleling the vertical plane of that of his patient, his nose will be outside of his left hand, which is automatically held flat by the position on the face, and the ophthalmoscope itself will also parallel the plane of the patient's face. This position is maintained by the little finger of the right hand, which can be raised or lowered as may be necessary. Now without disturbing the immobility of the instrument, the changing lens values can be made in the lens battery to obtain a very minute picture of the fundus in all its details. The nerve head can be examined and its depths measured; an almost impossible act to perform, claims Skeffington, accurately with any of the old technics because the moving of the instrument itself must necessarily nullify a goodly percentage of the accuracy the lens value obtained.

The arterial system can now, says Skeffington, be traced, its pulsations or lack of pulsations noted, and a minutely accurate focus obtained through whatever lens change may be necessary. The periphery of the nerve head and the fovea can also be studied. Then by a lowering of the fore finger of the left hand nearer to the eye, and a gradual turning of the instrument templewards, together with the closer approach of the examiner to the patient's face, the instrument can be swept templeward from the foveal area out to the last branching of the temporal artery and a study made of that portion of the fundus.

According to Skeffington many hitherto neglected threshold pathological problems escaped attention on the part of examiners.

As the light beam is moved over different portions of the fundus, the necessary lens changes can be made without disturbing the accuracy of the focus, owing to the immobility of the instrument as maintained by its resting against the index finger which in turn has the solid foundation of the hand resting against the patient's cheek. When the details of the fundus have been entirely comprehended, with the addition of plus the media may be studied and as more plus power is added in the lens battery the posterior and anterior lens capsule can be observed and the anterior chamber studied, the iris and any changes there can be minutely noted, and with addition of more plus power a magnified and illuminated view of the cornea and conjunctiva may also be obtained.

Leaving this excess plus power in the instrument, the examiner then moves to the other side of his patient, places his right hand on the left-hand side of the patient's face, in other words, merely reversing the technic, and with the instrument held in his left hand, makes an examination of the patient's left eye, this time beginning with the anterior portion, which is rendered highly visible by the plus power, and with a gradual decrease in plus lens power, finally approaching a focus on the fundus and a minute examination of the left eye following the same lines as outlined for the examination of the other eye.

By means of this modified technic, Skeffington claims we are enabled to make a study of the entire fundus to determine the existence of any chronic or acute pathological condition, to study the entire eyeball under ideal conditions, with the ophthalmoscope at all times under minute control. C. C. K.

BOOK NOTICE

HISTORY OF OPTOMETRY. E. E. Arrington. Published by the White Printing House, Chicago. 232 pages. Illustrated. $5.00. 1929.

Arrington has included in this history, recently published, much material which is not only of decided interest to optometrists but which in reviewing throws strong light on some of the prejudices which still find their way in and through our professional lives. For instance, he clearly shows in his early chapters that the opthalmological opposition to optometry did not arise from a disagreement over the mydriatic question at all—it is true this subject was somewhere injected into the argument—but rather the entire fight was purely a competitive one—it was a matter, not of science, ethics, etc., etc.,—but rather one of dollars and cents and one in which both

sides stooped to rather shabby tactics and much "mud-slinging" was, it now seems, gleefully engaged in.

Included in this text one finds a lengthy chapter dealing with Legal Decisions as effecting optometry. While favorable to our profession, these naturally do not make the most interesting of reading but are quite naturally included in a work of this kind and will prove helpful should the reader wish to refer to these at any future time.

The struggle for legislation is traced from its conception in the later part of the nineteenth century to the present day by the author. At the end of this portion of the book the New York Optometry Law is quoted in full.

Optometric educational activities are briefly reviewed, as are typical State Board Examination Questions. It is to be here regretted that more space was not given to tracing the development of optometric science from an educational standpoint, although the present optometric course at Columbia University, New York City, is written up in some detail.

Chapter 18 deals with optometric organizations. This is a very well written chapter which should be placed in the hands of every optometrist. Arrington here points out clearly the need for strong aggressive societies, developing this theme, as he well can in a work of this kind, with examples of successes which have come to the profession because of strong leadership in the past.

A chapter is fittingly devoted to Dr. A. J. Cross, the founder of Dynamic Skiametry and one of the men whose active interest in optometric matters was largely responsible for the course at Columbia and the New York Law. The writer rather expected to see similar small chapters dealing with other of our outstanding pioneers such as Eberhart, Lockwood, Prentice and others, and feels that this omission along with that on the development of educational centers already mentioned are the only two weak points in the book, which otherwise fully covers the field for which it is written.

"The History of Optometry" by Arrington, is, in one sense a companion book to Wiseman's "Building Optometry." Both books, non-technical in character are works which, when carefully read will unquestionably go far to giving us a greater pride in our profession thereby making us better practitioners. Arrington like Wiseman has performed a real service and the book he has had published should enjoy a wide distribution. C. C. K.

ANNOTATIONS AND SOCIETY PROCEEDINGS

The American Journal of Optometry is the Official Organ of the American Academy of Optometry, as well as the Organ of the Arkansas, Delaware, Indiana, Iowa, Maine, Maryland, Michigan, Minnesota, Nebraska, North Dakota, Oklahoma, Pennsylvania, South Dakota, Vermont and West Virginia Optometric Associations.

The following gentlemen have consented to supply items of interest from their respective sections, acting in the capacity of

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AMERICAN ACADEMY OF OPTOMETRY

The annual sessions of the American Academy of Optometry were held at the Hotel Statler December 15th, 16th, 17th and 18th at Boston, Massachusetts. The meeting was well attended and the sessions carried through with the usual thoroughness which accompanies meetings of this organization. Each session started at 9:15 A. M. and continued throughout the day and evening, meals being served the fellows in attendance in the lecture room. The complete program follows:

Sunday, December 15, 1929

Noon —General Assembly.

12:30 P. M.—*"Chairman's Address"* by Dr. Carel C. Koch of Minneapolis, Minnesota, following the Sunday Dinner—Dr. Walter I. Brown of New Bedford, Mass., presiding.

1:15 P. M.—*"Field Work"*—Dr. Howard C. Doane, Boston, Mass.

3:00 P. M.—Discussion.

3:30 P. M.—*"Reflected Light and Photography in the Measurement of Strabismus"*—Dr. E. G. Wiseman, Buffalo, N. Y.

4:30 P. M.—Discussion.

6:15 P. M.—Informal Sunday Supper—Dr. Fannie Gassett, Boston, Mass., presiding.

7:30 P. M.—*"Iridology"*—Dr. R. W. Bennett, Indianapolis, Indiana.

10:00 P. M.—Discussion.

Monday, December 16, 1929

9:15 A. M.—*"The Application of Telescopic Spectacles in Refraction"*—Dr. Wm. Feinbloom, New York City.

10:15 A. M.—Discussion.

10:30 A. M.—*"Need for More Accurate Definition of Our Technical Terms"*—Dr. R. M. Peckham, Los Angeles, Calif.

11:45 A. M.—Discussion.

12:15 P. M.—*"A Red, Green-blue Duction Test,"* a Luncheon Address—Dr. E. LeRoy Ryer, of New York City—Dr. Geo. S. Houghton, Boston, Mass., presiding.

1:30 P. M.—Discussion.

2:00 P. M.—Committee Reports:

(a) *Committee on New Instruments and Material*—Dr. W. I. Brown, New Bedford, Mass.

(b) *Committee on Physical Therapy*—Dr. J. I. Kurtz, Minneapolis, Minn.

2:30 P. M.—Business Session.

(a) *Secretary's Report*—Dr. J. Fred Andreae, Baltimore, Md.

(b) Election of Officers.

3:00 P. M.—Auto Tour of Boston.

7:00 P. M.—*"A Study of the Aqueous Humor by Means of Slit Lamp,"* a dinner address by Dr. Walter I. Brown, New Bedford, Mass.—Dr. C. R. Padleford, Fall River, Mass., presiding.

9:00 P. M.—Discussion.

Tuesday, December 17, 1929

9:15 A. M.—*"Results from the Use of Red Free Glass in Incipient Cataract"*—Dr. Elmer Hotaling, New York City.

10:30 A. M.—Discussion.

11:00 A. M.—*"The Psycho-Physiological and Philosophical Aspect of the Application of Ocular Physical Therapy"*—Dr. J. I. Kurtz, Minneapolis, Minn.

12:15 P. M.—*"Finger Treatment for Correcting Strabismus,"* a Luncheon Address by Dr. R. W. Bennett, Indianapolis, Ind.—Dr. O. L. McCulloch, Holyoke, Mass., presiding.

3:00 P. M.—Discussion.

3:30 P. M.—*"Mental Processes Worthy of Optometry and of Science"*—Dr. C. R. Padleford, Fall River, Mass.

4:30 P. M.—Discussion.

7:00 P. M.—Formal Round Table Dinner—Dr. Carel C. Koch, Minneapolis, Minn., presiding.

8:15 P. M.—*"The Treatment of Myopia and Functional Myopia"* —Dr. Edwin Forbes Tait, Philadelphia, Pa.

Wednesday, December 18, 1929

9:15 A. M.—*"Retinal Circulation"*—Dr. E. H. Silver, Washington, D. C.

10:15 A. M.—Discussion.

10:30 A. M.—*"The Etiology and Treatment of Strabismus"*—Dr. R. M. Hall, Cleveland, Ohio.

11:30 A. M.—Discussion.

12:15 P. M.—*"Focal Infection,"* a Luncheon Address by Dr. James H. Drakeford, New York City—Dr. C. E. Monroe, Springfield, Mass., presiding.

1:30 P. M.—Discussion.

2:00 P. M.—*"The Effect of Diathermy on the Restricted Color Fields"*—Dr. H. R. Spitler, Eaton, Ohio.

3:00 P. M.—Discussion.

3:30 P. M.—Business Session.

5:30 P. M.—Adjournment.

At the close of the annual session most fellows of the Academy spent a day in Southbridge, Massachusetts, as guests of the American Optical Company where an inspection of the entire plant was made and where the officials of this large manufacturing concern acted as hosts to the Academy members.

The new officers as elected in Boston for 1930 are as follows:

Dr. Briggs S. Palmer, Boston, Massachusetts, Chairman.

Dr. O. J. Melvin, Omaha, Nebraska, Vice-Chairman.

Dr. J. Fred Andreae, Baltimore, Maryland, Secretary.

In addition to the foregoing the Executive Council is composed of Dr. A. M. Skeffington, Kearney, Nebraska; Dr. Robert N. Walker, Winston-Salem, North Carolina; Dr. William F. Kinney, Los Angeles, California and Dr. C. R. Padleford, Fall River, Massachusetts. The 1930 sessions of the Academy wil be held in Omaha, Nebraska.

* * * * * *

MASSACHUSETTS MOTOR VISION SURVEY

New visual tests for motorists were inaugurated in the State of Massachusetts during the middle part of December when a new regulation became effective which requires all drivers of motor cars to come before the State motor car inspectors or else present a slip from some Optometrist certifying that their vision was normal in each of the following respects:

Eye Tests. Before the applicant is given a road test, the examiner shall make an eye test for visual acuity, for field of vision and for color perception. The cards for visual acuity are designed to be

used at a distance of twenty feet or not less than eighteen feet. The cards with small letters are designated 20/40; the larger size letters are designated 20/70. The applicant must be able to read the 20/70 letters at twenty feet. These tests shall be made with each eye separately both with and without glasses.

1. *Procedure.* Measure or pace twenty feet from a point at which the cards are to be placed. With the applicant standing at that distance from the card, the smaller card shall be exposed first. If the letters of this size are read correctly the notation should be made in the proper space provided on the application blank. If the small card cannot be read then the larger card is exposed and notation made as to applicant's ability to read this size letter. If he fails to read the larger size type, license will not be issued until vision is investigated thoroughly. In order to avoid memorizing, the test cards shall be displayed alternately and the applicant required to read letters in different positions on the card or to read the cards backwards or by switching from one card to another. While testing the right eye, applicant must cover his own left eye and vice versa. After each eye has been tested separately, the test is made with both eyes uncovered and the proper record made of vision with both eyes.

2. *Test for Field of Vision.* Applicant should be standing slightly less than arm distance from Examiner. Examiners shall require applicant to cover left eye with his own hand or fingers. Applicant is then directed to look at bridge of Examiner's nose. Examiner then places disk to right side on a level with applicant's eyes and back of the 90° meridian. Disk shall then be brought forward and applicant directed to indicate the moment he sees the disk. Examiner will then make notation of the angle at which the disk is first visible.

This test shall be made with each eye. If applicant has but one eye, test shall be made both from right side and from the left. Examiner shall make record of the total degrees of field.

3. *Color Test.* This test shall be made with various color disks as furnished. Applicant shall be required to designate green, yellow and red. This can be done by asking applicant to pick out the green or the red or the yellow. The blue and white disks are also used so that an applicant will positively demonstrate his ability to determine the red, green and yellow colors. This test may be varied by the examiners as it is found necessary to determine the applicant's color sense.

4. Applicant is passable if he can read 20/70 with or without glasses. An applicant must have a field of vision of 120° total. An applicant must be able to distinguish red, green and yellow colors. If applicant fails in any of these tests he shall be advised to have a thorough investigation made of his eyesight, and then apply for another examination when the defect has been remedied.

If an applicant passes the eye test with glasses, a record of this shall be made upon the examination permit in order that the license may be restricted to operation with properly fitted glasses.

If an applicant fails to show the required field of vision he will be required to have his automobile equipped with mirrors so situated as to give him a full field of vision both to right and left, and license will be restricted to operation with this provision.

IMPORTANT: All examiners and other employees of the Registry are forbidden to solicit or recommend that an applicant who has failed because of defective eyesight shall go to any particular person or partnership or corporation for treatment or glasses.

The inspectors mentioned in the foregoing are not Optometrists but have been specially trained by Dr. Howard C. Doane of Boston and his associates to make these tests accurately and quickly.

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OPTOMETRY EXAMINERS IN OKLAHOMA

The Board of Examiners in Optometry of the State of Oklahoma will hold an examination on the 20th, 21st and 22nd of January at the Huckins Hotel, Oklahoma City, Oklahoma. The members of the Board are: Dr. W. K. Grady, Stillwater, President; Dr. E. B. Alexander, Duncan, Secretary and Treasurer, and Dr. J. A. Clay, Durant. Applicants wishing to take this examination should communicate at once with any member of the Board.

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MISSISSIPPI VALLEY OPTOMETRIC SOCIETY

The regular meeting of the Mississippi Valley Optometric Research Society was held at the Lincoln Tavern, Sterling, Illinois, Tuesday evening, December 3rd. The evening was devoted to a discussion of routine examination procedure in which all members of the Society participated.

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OKLAHOMA ASSOCIATION OF OPTOMETRISTS

The Executive Council of the Oklahoma Association of Optometrists have recently divided the state into seven districts. Each district responsible for its organization work to its Chairman as appointed by Dr. E. R. Ross, President of the Association. The districts are as follows:

1. Central District—Dr. A. R. Blanchard, 35 N. Robinson, Oklahoma City, Chairman. District comprises the cities of Oklahoma City, El Rono, Guthrio, Chandler, Wewoka, Shawneo, Holdenville, Kingfisher and Norman.

2. Northeastern District—Dr. J. F. Batton, 512 S. Boston, Tulsa, Chairman. District comprises the cities of Tulsa, Claremore, Bartlesville, Pawhuska, Miami, Sapulpa, Okmulgee and Muskogeo.

3. Southwest District—Dr. Edward Carr, 423 Chickasha Ave., Chickasha, Chairman. District comprises the cities of Chickasha, Duncan, Lawton, Anadarko, Walters, Hobart, Frederick, Altus, Mangum and Hollis.

4. North Central District—Dr. C. H. Beavers, Enid, Chairman. District comprises the cities of Enid, Perry, Stillwater, Blackwell, Tonkawa, Newkirk and Ponca City.

5. Northwestern District—Dr. H. D. Brandt, Cherokee, Chairman. District comprises the cities of Cherokee, Alva, Woodward, Buffalo and Waynoka.

6. West Central District—Dr. C. T. Akers, Cordell, Chairman. District comprises the cities of Cordell, Elk City, Sayre, Weatherford, Clinton and Arapaho.

7. South Central District—Dr. J. A. Clay, Durant, Chairman. District comprises the cities of Durant, Hugo, Marietta, Ardmore, Pauls Valley, Sulphur, Ada, Coalgate, Atoka and Madill.

During the month of December Dr. R. M. Peckham presented several talks on the Arneson Technique in the correction of Squint within the State of Oklahoma.

During January, under the auspices of the State Association, Dr. A. M. Skeffington of the Graduate Foundation, will give a series of clinics within the State. The first of these will be held at Tulsa on January 13th, 14th and 15th. The second will be held at Enid January 16th, 17th and 18th, the third clinic has been arranged for Oklahoma City January 19th, 20th and 21st, with the final clinic for Lawton on the 23rd, 24th and 25th. Members of the Oklahoma Association of Optometrists are urged to attend any or all of these clinics as the Executive Committee are confident that the work will come up to the usual high standards as set for the graduate foundation.

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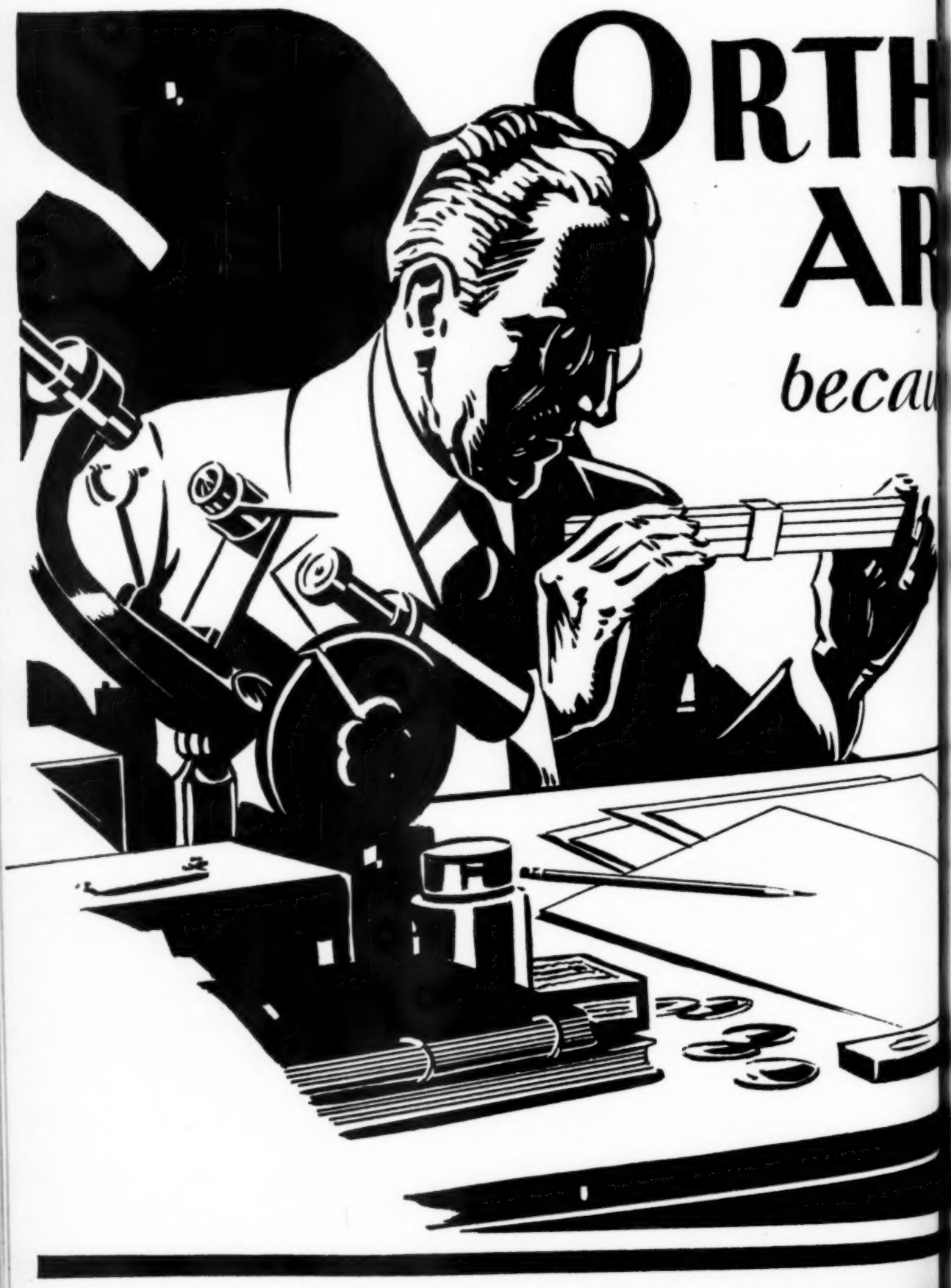
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